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with Early Planting of Early-Maturing Soybean Varieties

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Stabilizing Soybean Production in Northeast Texas With Early Planting of Early-Maturing Soybean Varieties

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Introduction

Soybeans have been produced in Northeast Texas for many years but production has varied widely. Harvested acreage has fluctuated from a high of 129,000 acres in 1979 (3) to a low of 32,100 acres in 1985 (2). Changes in soybean acreage are often abrupt. In 1980, 108,300 acres were harvested (4), dropping to 63,600 the following year (5). Average annual yields have been equally sporadic, ranging from 25 bu/A in 1979 (3) to 13 bu/A in 1980 (4).

Acreage fluctuations generally result from environmental and price instabilities. Nonirrigated soybeans grown on the area's blackland soils are most susceptible to environmental hazards. Historically, the area experiences a prolonged hot, dry period in July and August, coinciding with the blooming and seed-filling periods of Maturity Groups (MG) V, VI, and VII soybean varieties planted in May or early June, which are harvested in October. This traditional soybean-production system is occasionally successful on the deep, well-drained river bottom soils and in years of good summer rainfall. However, soils with good water storing capacity are limited and comprise only 20% — 35% of the area. Production of conventional maturity soybeans is a high-risk enterprise in most of Northeast Texas.

In the late 1970's and early 1980's, an interest existed in adding soybeans to the cotton-sorghum rotation of the Coastal Bend area of Texas. The conventional Upper Gulf Coast production system of planting MG V through VIII soybean varieties in late May and early June was attempted but with poor results because of drought periods in July and August, similar to those of Northeast Texas. Research by the Texas Agricultural Extension Service and the Texas Agricultural Experiment Station, coupled with producer experience, found that planting MG IV soybean varieties in April gave more satisfactory and consistent results. These varieties matured in late July or early August, thereby avoiding drought stress during critical developmental stages and utilizing stored soil moisture and spring rainfall more efficiently.

Since the environmental stress periods experienced in both areas were similar, the strategy developed for the Coastal Bend was applied to Northeast Texas. Previously published results (1) of this research showed that April-planted MG III and IV varieties provided a potential production system for the drought-prone areas of Northeast Texas. This report details results from the 1988 study and summarizes the results from a 3-year study comparing the agronomic performance of MG III and IV varieties planted in April with MG V, VI, and VII varieties planted in May.

Materials and Methods

Test plots were located near Blossom and Hooks, Texas. The test at each location consisted of four replications in a split-plot randomized complete block design with two planting dates as main plots and 12 varieties as subplots. The 12 soybean varieties and their respective maturity groups included Williams 82 (MG III), Asgrow 3966 (MG III), FFR 441 (MG IV), Crawford (MG IV), Egyptian (MG IV), RA 451 (MG IV), Asgrow 5474 (MG V), Forrest (MG V), Centennial (MG VI), Leflore (MG VI), Bragg (MG VII), and Hartz 7126 (MG VII). Seeds of each variety were planted in bedded rows at the rate of eight viable seeds per linear foot of row. Supplemental irrigation was not applied. Weeds were controlled with post-emergence herbicides, cultivation, and hand weeding as required. Table 1 gives general cultural information.

Table 1. Location, soil type, and cultural information for a test comparing Maturity Group III-VII soybean varieties planted in both April and May 1988 in Northeast Texas.

Location:	Blossom	Hooks
Soil Type:	Houston black clay	Severn silt loam
Previous Crop:	Soybeans	Soybeans
Planting Date:	22 April, 6 May	21 April, 7 May
Test Design:	Split-plot randomized complete block	Split-plot randomized complete block
Plot Size:	4 rows, 34" x 19'	4 rows, 36" x 19'
Fertilizer:	0-60-60	0-60-60
Herbicide:	2.0 pt/A Dual and 0.67 pt/A Scepter	2.0 pt/A Dual and 0.67 pt/A Scepter
Insecticide:	0.75 lb/A Sevin XLR for blister beetle on 21 June	None
Size Harvested Plot:	2 rows, 14.5'	2 rows, 14.5'

Maturity date, yield, plant height, pod height, lodging, seed quality, and seed weight were recorded. Data were subjected to standard analysis of variance procedures and means separated with the Duncan's Multiple Range Test (P=0.05).

Results and Discussion

The May-planting date at both locations had poor stands due to inadequate soil moisture at and shortly after

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planting and were subsequently abandoned. Therefore, discussion of the results obtained in 1988 will be confined to the tests planted in April.

Table 2 shows the data from the 21 April 1988 planting date at Hooks. Two of the earliest maturing varieties (Asgrow 3966 and FFR 441) were the only varieties with yields significantly lower than the highest yielding variety (Asgrow 5474) in that test. This contrasts with previous findings (1) from 1986 and 1987 when the earliest maturing varieties, such as Asgrow 3966, were among the highest yielding varieties. Differences were found between varieties for the other traits measured, including plant height, with the four latest maturing cultivars being significantly taller.

In general, yields at the Blossom site (Table 3) planted on 22 April 1988 were lower than at Hooks, primarily due to the poor moisture availability of the soil. There was a strong correlation between maturity and yield for the April-planted soybeans in both 1986 and 1987, with the earliest maturing varieties having the highest yields (1). However, in 1988 (Table 3) the late MG IV and MG V varieties, such as Crawford, RA 451, and Forrest, yielded significantly more

Table 2. Performance of soybean varieties planted on 21 April 1988 near Hooks, Texas on a Severn silt loam.

Maturity Group	Variety	Maturity Date	Yield (bu/A)	Height (in.) Plant	Height (in.) Pod	Lodging [1]	Seed Quality[2]	Seed Weight (g/100)
III	Williams 82	8/26	35.6 abc	27 bc	5.3 abc	2.0 cde	2.1 b	14.0 cd
III	Asgrow 3966	8/25	19.3 c	25 c	5.3 abc	1.8 de	3.0 a	14.5 bc
IV	FFR 441	8/28	33.0 bc	30 b	5.8 ab	2.5 abcd	2.4 ab	17.1 a
IV	Crawford	9/16	47.9 ab	36 a	6.3 ab	3.0 a	2.5 ab	17.2 a
IV	Egyptian	9/15	34.8 abc	20 d	3.8 c	1.4 e	2.5 ab	13.2 cde
IV	RA 451	10/7	41.8 ab	39 a	6.8 a	2.9 ab	2.5 ab	17.5 a
V	Asgrow 5474	9/23	54.4 a	28 bc	6.8 a	1.9 cde	1.8 b	15.6 b
V	Forrest	9/24	46.8 ab	30 b	6.0 ab	1.9 cde	2.0 b	12.4 de
VI	Centennial	10/22	45.6 ab	36 a	4.5 bc	2.1 bcde	1.8 b	12.7 de
VI	Leflore	10/22	40.5 ab	35 a	4.5 bc	2.4 abcd	2.1 b	12.0 e
VII	Bragg	10/30	38.0 abc	39 a	4.8 bc	2.6 abc	2.3 ab	13.9 cd
VII	Hartz 7126	10/27	43.4 ab	37 a	5.0 abc	2.1 bcde	2.0 b	12.7 de

[1]Lodging scores based on a scale of 1 to 5 with 1= nearly all plants erect and 5= nearly all plants prostrate.
[2]Visual seed quality scores based on a scale of 1 to 5 with a rating of 1 indicating excellent seed quality.
[3] Values, within columns, followed by the same letter are not significantly different (P=0.05) using Duncan's Multiple Range Test.

Table 3. Performance of soybean varieties planted on 22 April 1988 near Blossom, Texas on a Houston black clay.

Maturity Group	Variety	Maturity Date	Yield (bu/A)	Height (in.) Plant	Height (in.) Pod	Lodging [1]	Seed Quality[2]	Seed Weight (g/100)
III	Williams 82	9/4	22.6 de	24 e	4.3 de	1.9 abc	1.6 d	17.1 bc
III	Asgrow 3966	9/3	24.5 cd	24 e	4.8 cde	1.5 c	2.1 bcd	16.7 cd
IV	FFR 441	9/4	26.6 cd	26 de	3.5 e	1.8 bc	2.6 b	20.7 a
IV	Crawford	9/7	34.5 ab	29 d	4.8 cde	1.6 bc	2.0 cd	17.8 b
IV	Egyptian	9/6	30.0 bc	29 d	3.8 e	1.5 c	1.8 d	12.3 hi
IV	RA 451	9/23	35.2 ab	35 c	4.3 de	2.4 a	2.0 cd	14.0 fg
V	Asgrow 5474	9/21	29.8 bc	37 bc	8.0 a	2.0 abc	2.5 bc	13.1 gh
V	Forrest	9/25	37.6 a	38 abc	3.8 e	2.1 ab	3.5 a	11.3 i
VI	Centennial	10/27	23.6 cd	35 c	5.0 bcde	1.9 abc	2.5 bc	14.9 ef
VI	Leflore	10/21	23.3 cd	36 c	6.5 b	2.0 abc	2.0 cd	13.6 g
VII	Bragg	10/28	16.1 e	40 ab	6.3 bc	2.0 abc	2.4 bc	15.0 ef
VII	Hartz 7126	10/30	21.8 de	41 a	5.8 bcd	2.1 ab	2.0 cd	15.8 de

[1]Lodging scores based on a scale of 1 to 5 with 1= nearly all plants erect and 5= nearly all plants prostrate.
[2] Visual seed quality scores based on a scale of 1 to 5 with a rating of 1 indicating excellent seed quality.
[3] Values, within columns, followed by the same letter are not significantly different (P=0.05) using Duncan's Multiple Range Test.

than the MG III and early MG IV varieties like Williams 82, Asgrow 3966, and FFR 441. The medium-maturity varieties also significantly out-yielded the MG VI and VII varieties in the test. Significant differences were found for all other traits measured.

An inverted pattern of rainfall distribution occurred in 1988 as compared to the 2 previous years. At Hooks the total rainfall accumulation from April through June was 17.8 inches, 8.4 inches, and 3.0 inches in 1986, 1987, and 1988, respectively. The combined total rainfall for the months of July and August was approximately 4 inches in both 1986 and 1987, while rainfall totaled 10.9 inches in 1988. This shows that the typical pattern for the area of late-spring and early-summer rains, followed by a period of summer droughts, was reversed in 1988. A similar temporal pattern for rainfall occurred at the Blossom site in 1988, with a May-June rainfall total of 1.4 inches and a total rainfall for July-August of 7.0 inches.

Results from the 1988 tests confirm the benefits of the early-planted/early-maturity production system (mid-April planting of late MG III and MG IV soybean varieties). The loss of the May planting at both locations further illustrates the difficulty producers faced with the conventional system (planting MG V, VI, or VII varieties in May or early June) in 1988. Soil moisture was low at both locations until late- June early-July. Delaying planting until that time initiates a production season under suboptimal conditions for growth. Reduced plant height caused by planting past the optimal planting time leads to reduced potential yield. Planting late also moves maturity later into the year exposing the system to the risks of early frosts and harvesting under wet conditions.

Even under the deep, well-drained river bottom soil conditions found at Hooks and in an atypical year like 1988, early-maturing varieties like Williams 82 and Crawford yielded as well as late-maturing varieties such as Centennial and Bragg planted early (Table 2, Fig. 1). Even though the Hooks site received ample rainfall each month during the 1987 production season, the temporal distribution of the rainfall was not uniform resulting in periods of severe drought stress. All varieties yielded lower in 1987 than in 1986 or 1988. However, the early-planted/early-maturity system out-yielded the conventional system or the early-planted/late-maturity system (mid-April planting of MG V, VI, or VII varieties) (1). In 1986, with the typical early-season rainfall and late-summer drought, the varieties in the early-planted/early-maturity system yielded as well as or better than varieties in the late-planted/early-maturity or the conventional systems (1).

At Blossom in 1988, late-summer rains increased yields in the early-planted/late-maturity system (Table 3, Fig. 2). The lack of spring and early-summer rainfall reduced yields of early-planted/early-maturing varieties such as Williams 82 (Table 3, Fig. 2). Still, the early-planted/early-maturity system was not penalized with significantly lower yields. Under typical weather conditions of late-spring and early-summer rain followed by a late-summer drought found in both 1986 and 1987, the early-planted/early-maturity system produced yields significantly greater than either of the other two systems (1).

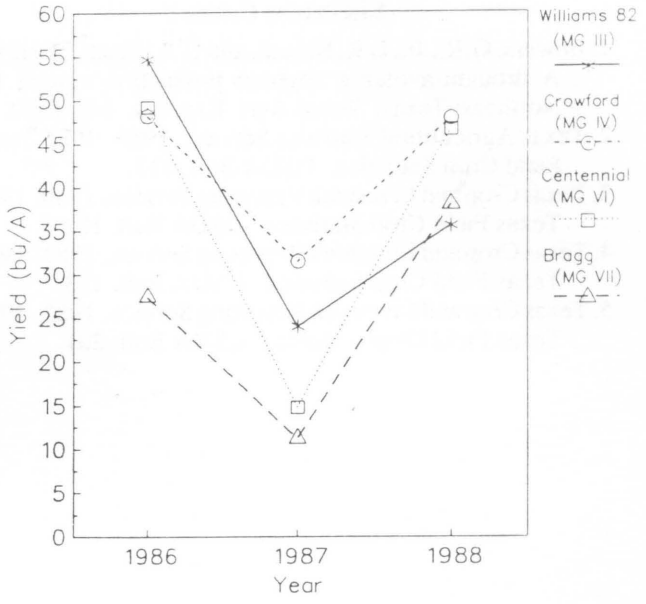

Figure 1. Yield performance of four selected cultivars planted in mid-April near Hooks, Texas on Severn silt loam from 1986-88.

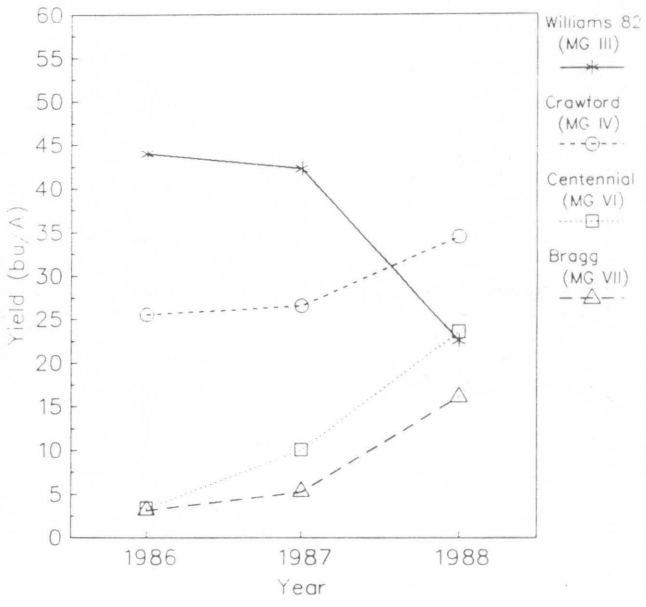

Figure 2. Yield performance of four selected cultivars planted in mid-April near Blossom, Texas on Houston black clay from 1986-88.

Even though the period of drought stress in 1988 occurred at an unusual time of year, the early-planting/early-maturing production system was an effective way of dealing with the drought stress. The stability over years and higher yields obtained with the early-planting/early-maturity system is shown in Figures 1 and 2. The results from the 3-year study indicate that the early-planted/early-maturity system stabilizes yield and reduces the risks associated with soybean production in Northeast Texas.

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